

List of Claims

1. (original) A control system for determining the net power output of an engine associated with a work machine or other vehicle wherein the work machine or other vehicle includes an engine operable to provide power to at least two power-operated components, at least one of the power-operated components being a parasitic load component, said control system comprising:

an electronic controller coupled to the engine;

at least one sensor coupled to said controller for inputting at least one signal thereto representative of certain operating conditions of the engine;

said controller being operable to determine the total output power of the engine based upon said at least one sensor signal;

a<sup>1</sup> at least one other sensor coupled to said controller for inputting at least one signal thereto representative of the operation of the at least one parasitic load component;

said controller having memory associated therewith and having data stored therein relating to the power requirements of the at least one parasitic load component when said component is in operation at a plurality of engine speeds;

said controller being operable to determine the power requirements of the at least one parasitic load component based upon said at least one other sensor signal; and

said controller being operable to provide an output signal representative of the difference between the total output power of the engine and the power requirements associated with the at least one parasitic load component.

2. (original) The control system as set forth in claim 1 wherein at least one of said sensors coupled to said controller inputs a signal representative of engine speed.

3. (original) The control system as defined in claim 1 wherein at least one of said sensors coupled to said controller inputs a signal representative of throttle position.

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4. (original) The control system as set forth in claim 1 wherein at least one of said sensors coupled to said controller inputs a signal representative of the amount of fuel being delivered to the engine.

5. (original) The control system as set forth in claim 1 wherein at least one of said other sensors coupled to said controller inputs a signal representative of the fluid pressure associated with a hydraulic pump.

6. (original) The control system as set forth in claim 1 wherein at least one of said other sensors coupled to said controller inputs a signal representative of the pressure associated with an air conditioning compressor.

a' 7. (original) The control system as set forth in claim 1 wherein the at least one parasitic load component operates at a substantially constant power requirement.

8. (original) The control system as set forth in claim 1 wherein the at least one parasitic load component operates at varying power requirements.

9. (original) The control system as set forth in claim 1 wherein the engine is operable to provide power to a plurality of parasitic load components, said controller memory having stored therein data relating to the power requirements of each of said parasitic load components when said components are in operation at a plurality of engine speeds.

10. (original) The control system as set forth in claim 9 wherein at least one of the parasitic load components operates at a substantially constant power requirement and wherein at least one of the parasitic load components operates at a varying power requirement.

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11. (original) The control system as set forth in claim 9 wherein the data stored within the memory of said controller relating to the power requirements of a parasitic load component which operates at varying power requirements includes data relating to the operation of said parasitic load component at a plurality of different power requirements for each of said plurality of engine speeds.

12. (original) The control system as set forth in claim 1 wherein the work machine or other vehicle includes a transmission controller, said controller being operable to output said output signal to said transmission controller to control the shifting of the transmission.

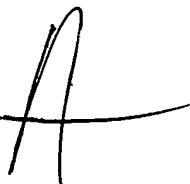
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13. (original) The control system as set forth in claim 12 wherein the transmission is an automatic transmission and said output signal is used to effect automatic shifting of the transmission in accordance with programmed instructions based upon the net power output of the engine.

14. (original) The control system as set forth in claim 12 wherein the transmission is a manual transmission operable for shifting by an operator, said output signal being used to provide a shift signal to the operator to effect manual shifting of the transmission in accordance with programmed instructions based upon the net power output of the engine.

15. (original) The control system as set forth in claim 1 wherein said output signal is used to control the operation of the engine.

16. (original) A work machine or other vehicle comprising:  
an engine having variable output power and operable to provide power to at least two power-operated components, at least one of said power-operated components being a parasitic load component;

a control system operable to control operation of at least a portion of the work machine or other vehicle in response to the power requirements of said at least two



power-operated components, said control system including an electronic controller coupled to said engine and at least one sensor coupled to said electronic controller and operable to provide a signal indicative of at least one operating parameter of said engine;

said controller having memory associated therewith and having information stored therein correlating said at least one engine operating parameter to the total power output of said engine at a plurality of engine speeds and having additional information stored therein correlating the operation of said at least one parasitic load component to the power required for such operation at a plurality of engine speeds;

a' said controller being operable to determine the net power output of said engine by determining the difference between the total output power of the engine and the power requirement associated with said at least one parasitic load component, and to output a signal representative thereof to control operation of at least a portion of the work machine.

17. (original) The work machine as set forth in claim 16 including a plurality of said at least one parasitic load components, information relating to the power requirements of each of said parasitic load components being stored within the memory of said controller.

18. (original) The work machine as set forth in claim 17 wherein at least one of said parasitic load components operates at a substantially constant power requirement and wherein at least one of the parasitic load components operates at a varying power requirement.

19. (original) The work device as set forth in claim 18 wherein the information stored within the memory of said controller relating to the power requirements of a parasitic load component operating at a substantially constant power requirement includes information correlating the power requirements of said parasitic load component at a plurality of engine speeds, and wherein the information stored within the memory of said controller relating to the power requirements of a parasitic load

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component operating at a varying power requirement includes information correlating a plurality of different power requirements for each of said plurality of engine speeds.

20. (original) The work machine as set forth in claim 16 wherein said controller is further operable to output a signal representative of the power requirement of said at least one parasitic load component.

21. (original) The work machine as set forth in claim 16 wherein said work machine includes a transmission, said output signal being operable to indicate when the power is adequate for effecting shifting of said transmission.

22. (original) The work machine as set forth in claim 21 wherein said transmission is an automatic transmission and said output signal is used to effect automatic shifting of said transmission in accordance with predetermined criteria.

23. (original) The work machine as set forth in claim 21 wherein said transmission is manually operable for shifting by an operator, said output signal being used to provide a shift signal to the operator to effect shifting of the transmission in accordance with predetermined criteria.

24. (original) The work machine as set forth in claim 16 wherein said output signal is used to control the operation of the engine in accordance with predetermined criteria.

25. (original) The work machine as set forth in claim 24 wherein said engine is controlled in response to said output signal to ensure adequate total power output of said engine.

26. (original) A method of operating a power-operated work machine having a variable power output engine operable to drive a plurality of power-operated components at least one of which being a parasitic load component, the work machine

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having an electronic controller operably connected to the engine and operable to control operation of at least a portion of the work machine, said method comprising:

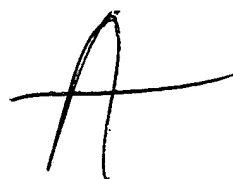
generating a first signal indicative of the total power output of the engine;  
generating a second signal indicative of the power requirement of the at least one parasitic load component;  
generating a third signal indicative of the difference between the total power output of the engine and the at least one parasitic load component power requirement; and  
utilizing the third signal for controlling operation of at least a portion of the work machine.

a' 27. (original) The method as set forth in claim 26 wherein the third signal is utilized to control shifting of a transmission operably connected to the engine.

28. (original) The method as set forth in claim 26 including processing the third signal to determine if the difference between the total power output and parasitic load component power requirement is adequate for accomplishing a particular task and generating a fourth signal indicative of the adequacy of said power difference.

29. (original) A method for determining the net power output of an engine associated with a work machine or other vehicle wherein the work machine or other vehicle includes an engine operable to provide power to at least two power-operated components, at least one of the power-operated components being a parasitic load component, the method comprising the steps of:

providing an electronic controller coupled to the engine;  
sensing at least one engine parameter representative of the operating condition of the engine;  
determining the total output power of the engine based upon said at least one sensed engine parameter;



sensing whether said at least one parasitic load component is in operation during operation of the engine;

determining the power requirement associated with the at least one parasitic load component when said component is in operation;

determining the difference between the total output power of the engine and the power requirement associated with the at least one parasitic load component; and

outputting a signal representative of the difference between the total output power of the engine and the power requirement associated with the at least one parasitic load component.

30. (original) The method as set forth in claim 29 wherein the step of determining the power requirement associated with the at least one parasitic load component when said component is in operation is accomplished through a calibration process, said calibration process including the steps of:

a<sup>1</sup> operating the engine with no parasitic load component in operation at a plurality of different engine operating conditions;

operating the engine and a selected one of the at least one parasitic load components at said plurality of different engine operating conditions;

comparing the operation of the engine with no parasitic load component in operation with the operation of the engine with the selected one parasitic load component in operation at each of said plurality of different operating conditions;

recording the effect of the operation of the selected one parasitic load component upon engine power at each of said plurality of different operating conditions;

storing the effect of the operation of the selected one parasitic load component upon engine power at each of said plurality of different engine operating conditions within the memory of said electronic controller; and

correlating the effect of the operation of the selected one parasitic load component at each of said plurality of different engine operating conditions with a power requirement at each of said plurality of different engine operating conditions.

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✓ 31. (original) A method of calculating parasitic load requirements associated with an engine installed in an on-highway truck, said method comprising:

- determining engine speed;
- determining load on the engine;
- determining whether the engine speed is within a tolerance of a predetermined value;
- determining the fuel command in response to the engine speed being with a tolerance of said predetermined value and the load being less than a predetermined load value; and
- comparing the fuel command to a no load fuel command stored in memory.

32. (original) The method of claim 31, further comprising:

- determining parasitic load in response to said step of comparing the fuel command to the no load fuel command.

33. (original) The method of claim 31, further comprising:

- modifying subsequent fuel delivery commands as a function of said step of comparing the fuel command to a no load fuel command stored in memory.

34. (original) The method of claim 31, further comprising:

- determining a fuel command adjustment as a function of said step of comparing the fuel command to said no load fuel command; and
- modifying subsequent fuel delivery commands as a function of said fuel command adjustment.

<sup>35</sup>  
~~34~~. (original) The method of claim 32, wherein said parasitic load is used to modify subsequent fuel delivery commands.

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<sup>36</sup><sub>35.</sub> (currently amended) An internal combustion engine, installed in a vehicle and being operably coupled to at least one parasitic load when in a no-load condition, comprising:

an electronic controller which includes a no load calibration algorithm that includes a parasitic load requirement determination algorithm;

a fuel system operatively connected with said electronic controller and introducing fuel into cylinders of said internal combustion engine in response to fuel delivery command signals produced by said electronic controller;

an engine speed sensor operatively connected with said electronic controller;

at least one vehicle parameter sensor;

wherein said electronic controller determines that said engine is running in a no load condition at least in response to a signal from said vehicle parameter sensor, and responsively stores a value representative of fuel delivered to the engine cylinders and a value representative of engine speed.

<sup>37</sup><sub>36.</sub> (original) An internal combustion engine according to claim <sup>36</sup><sub>35</sub>, wherein said fuel system includes a plurality of fuel injectors.

<sup>38</sup><sub>37.</sub> (original) An internal combustion engine according to claim <sup>36</sup><sub>35</sub>, wherein said vehicle parameter sensor includes at least one of: a transmission gear ratio sensor; a vehicle speed sensor; a parking brake switch; and a neutral switch.

<sup>39</sup><sub>38.</sub> (original) An internal combustion engine according to claim <sup>38</sup><sub>37</sub>, wherein said engine controller determines that said engine is operating in a no load condition at least as a function of said vehicle speed signal indicative of the vehicle being stationary.

<sup>40</sup><sub>39.</sub> (currently amended) ~~An internal combustion engine according to claim 38,~~ An internal combustion engine, installed in a vehicle, comprising:  
an electronic controller;

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a fuel system operatively connected with said electronic controller and introducing fuel into cylinders of said internal combustion engine in response to fuel delivery command signals produced by said electronic controller;

an engine speed sensor operatively connected with said electronic controller;

at least one vehicle parameter sensor;

wherein said electronic controller determines that said engine is running in a no load condition at least in response to a signal from said vehicle parameter sensor, and responsively stores a value representative of fuel delivered to the engine cylinders and a value representative of engine speed;

wherein said vehicle parameter sensor includes at least one of: a transmission gear ratio sensor; a vehicle speed sensor; a parking brake switch; and a neutral switch;

wherein said engine controller determines that said engine is operating in a no load condition at least as a function of said vehicle speed signal indicative of the vehicle being stationary; and

wherein said engine controller determines that said engine speed signal is within a predetermined tolerance of a value representative of a first predetermined engine speed for greater than a predetermined time and responsively stores a first no load fuel command value corresponding to said first predetermined engine speed.

<sup>41</sup>/<sub>40</sub>. (original) An internal combustion engine according to claim <sup>46</sup>/<sub>39</sub>, wherein said engine controller determines that said engine speed signal is within a predetermined tolerance of a value representative of a second predetermined engine speed for greater than a predetermined time and responsively stores a second no load fuel command value corresponding to said second engine speed.

<sup>42</sup>/<sub>41</sub>. (original) An internal combustion engine according to claim <sup>41</sup>/<sub>40</sub>, wherein said engine controller calculates no load fuel command values for engine speeds other than said first and second predetermined engine speeds, said calculation being a function of said first and second no load fuel command values.

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<sup>43</sup><sub>42</sub>. (currently amended) A method for controlling an internal combustion engine, comprising:  
determining a no load fuel command at a predetermined engine speed when said engine is operating under no load condition that includes at least one parasitic load;

using said no load fuel command to develop fuel delivery signals when said engine is operating under a load that includes said at least one parasitic load.

<sup>44</sup><sub>43</sub>. (currently amended) A method according to claim <sup>43</sup><sub>42</sub>, further comprising:

determining a second no load fuel command at a second predetermined engine speed when said engine is operating under no load condition that includes said at least one parasitic load;

calculating a no load fuel command for at least one engine speed other than said predetermined engine speed and said second predetermined engine speed, said calculation being a function of said no load fuel command and said second no load fuel command;

using said calculated no load fuel command to determine a fuel delivery command when said engine is operating under a load that includes said at least one parasitic load and at said one other engine speed.

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